

APPENDIX

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APPENDIX A

Table A1. Cooling time and core produce temperature of vacuum cooling

Time (min)	Produce temp (°C)	Time (min)	Produce temp (°C)
0	23	22	7.7
1	22.3	23	7.6
2	22.1	24	7.6
3	22	25	7.5
4	21.8	26	7.5
5	21.9	27	7
6	22.2	28	7
7	21.3	29	7
8	19.1	30	6.8
9	17.3	31	6.5
10	15.4	32	6.5
11	13.4	33	6
12	10.7	34	5.8
13	10	35	5.8
14	9.1	36	5.5
15	8.6		
16	8.3		
17	8.1		
18	7.9		
19	7.8		
20	7.8		
21	7.7		

Table A.2 Cooling time and core produce temperature of forced-air cooling

Time (min)	Produce temp (°C)	Time (min)	Produce temp (°C)
0	24.3	84	7.5
3	22.1	87	7.3
6	21.4	90	7.2
9	19.8	93	7.0
12	18.6	96	6.9
15	17.8	99	6.7
18	16.8	102	6.6
21	16.0	105	6.4
24	15.2	108	6.2
27	14.4	111	6.0
30	13.7	114	5.8
33	13.1	117	5.7
36	12.6	120	5.5
39	12.0		
42	11.5		
45	11.1		
48	10.8		
51	10.3		
54	9.9		
57	9.6		
60	9.3		
63	9.0		
66	8.7		
69	8.5		
72	8.2		
75	8.1		
78	7.9		
81	7.7		

Table A.3 Cooling time and core produce temperature of room cooling

Time (min)	Produce temp (°C)	Time (min)	Produce temp (°C)	Time (min)	Produce temp (°C)
0	21.2	84	16.5	168	11.4
3	21.0	87	16.2	171	11.3
6	20.8	90	16.0	174	11.1
9	20.6	93	15.8	177	11.0
12	20.6	96	15.5	180	10.9
15	20.6	99	15.3	183	10.8
18	20.5	102	15.1	186	10.6
21	20.5	105	14.9	189	10.5
24	20.4	108	14.7	192	10.4
27	20.3	111	14.5	195	10.3
30	20.1	114	14.3	198	10.2
33	20.0	117	14.1	201	10.1
36	19.8	120	13.9	204	10.0
39	19.7	123	13.7	207	9.9
42	19.5	126	13.5	210	9.8
45	19.3	129	13.3	213	9.7
48	19.1	132	13.1	216	9.6
51	18.9	135	13	219	9.5
54	18.7	138	12.8	222	9.5
57	18.5	141	12.7	225	9.4
60	18.3	144	12.5	228	9.2
63	18.1	147	12.4	231	9.1
66	17.8	150	12.2	234	9.0
69	17.6	153	12.1	237	8.9
72	17.4	156	11.9	240	8.8
75	17.2	159	11.8	243	8.8
78	16.9	162	11.7	246	8.7
81	16.7	165	11.5	249	8.6

Table A.3 Cooling time and core produce temperature of room cooling (continued)

Time (min)	Produce temp(°C)	Time (min)	Produce temp(°C)	Time (min)	Produce temp(°C)
252	8.5	336	7.2	420	6.7
255	8.5	339	7.2	423	6.7
258	8.4	342	7.2	426	6.6
261	8.3	345	7.3	429	6.6
264	8.3	348	7.3	432	6.6
267	8.2	351	7.3	435	6.5
270	8.1	354	7.4	438	6.5
273	8.1	357	7.4	441	6.4
276	8.0	360	7.4	444	6.4
279	8.0	363	7.4	447	6.4
282	7.9	366	7.4	450	6.3
285	7.8	369	7.4	453	6.3
288	7.8	372	7.3	456	6.3
291	7.7	375	7.3	459	6.2
294	7.7	378	7.2	462	6.2
297	7.6	381	7.2	465	6.1
300	7.6	384	7.2	468	6.1
303	7.5	387	7.1	471	6.1
306	7.5	390	7.1	474	6.0
309	7.4	393	7.1	477	6.0
312	7.4	396	7.0	480	6.0
315	7.4	399	7.0	483	5.9
318	7.3	402	6.9	486	5.9
321	7.3	405	6.9	489	5.8
324	7.3	408	6.9	492	5.8
327	7.2	411	6.8	495	5.8
330	7.2	414	6.8	498	5.7
333	7.2	417	6.8	501	5.7

Table A.3 Cooling time and core produce temperature of room cooling (continued)

Time (min)	Produce temp (°C)
504	5.7
507	5.6
510	5.6
513	5.5
516	5.5
519	5.5
522	5.4
525	5.4

Table A.4 The ANOVA test for MLR final temperature prediction

ANOVA					
Final temperature Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	1.687	7	0.241	8.566	0.000
Residual	1.238	44	0.028		
Total	2.924	51			

Table A.5 The ANOVA test for MLR weight loss percentage prediction

ANOVA					
Weight loss (%) Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	1.399	10	0.140	5.727	0.000
Residual	1.001	41	0.024		
Total	2.400	51			

Table A.6 Weight loss, texture and overall visual quality of baby cos lettuce during storage at 4 °C with 85 % RH

<i>Storage period</i>	<i>Treatment</i>	<i>Weight loss (%)</i>	<i>Texture (KN/Kg) (Crispness coefficient)</i>	<i>Overall visual quality (score)</i>
<i>1 day</i>	Control	0.03 ± 0.04 ^b	0.910 ± 0.044 ^b	8.2 ± 0.8 ^a
	Forced-air	0.09 ± 0.02 ^a	0.928 ± 0.018 ^{ab}	8.4 ± 0.9 ^a
	Vacuum	0.11 ± 0.00 ^a	0.921 ± 0.015 ^{ab}	7.8 ± 1.3 ^a
	Room	0.12 ± 0.02 ^a	0.942 ± 0.014 ^a	8.4 ± 0.6 ^a
<i>7 days</i>	Control	0.49 ± 0.16 ^b	0.892 ± 0.019 ^b	6.67 ± 0.58 ^a
	Forced-air	1.07 ± 0.22 ^a	0.919 ± 0.014 ^a	6.50 ± 0.58 ^a
	Vacuum	0.51 ± 0.11 ^b	0.916 ± 0.013 ^a	6.67 ± 1.15 ^a
	Room	1.23 ± 0.09 ^a	0.920 ± 0.010 ^a	6.00 ± 1.00 ^a
<i>11 days</i>	Forced-air	1.52 ± 0.20 ^a	0.905 ± 0.013 ^a	6.00 ± 0.71 ^a
	Vacuum	0.86 ± 0.11 ^b	0.900 ± 0.017 ^a	6.80 ± 0.84 ^a
	Room	1.77 ± 0.10 ^a	0.906 ± 0.014 ^a	6.00 ± 0.71 ^a

Values designated by the same letter are not significantly different ($p > 0.05$). Lower case letter are used for comparisons during storage.

Table A.7 Chlorophyll content, carotenoid content and total soluble solids of baby cos lettuce during storage at 4 °C with 85 % RH

<i>Storage period</i>	<i>Treatment</i>	<i>Chlorophyll content</i> ($\mu\text{g/g FW}$)	<i>Carotenoid content</i> ($\mu\text{g/g FW}$)	<i>TSS</i> (%)
<i>1 day</i>	Control	47.60 \pm 2.03 ^c	1.60 \pm 0.10 ^b	2.93 \pm 0.06 ^b
	Forced-air	57.36 \pm 2.04 ^a	1.78 \pm 0.08 ^{ab}	3.27 \pm 0.23 ^a
	Vacuum	52.53 \pm 1.42 ^b	1.55 \pm 0.12 ^b	3.10 \pm 0.17 ^{ab}
	Room	50.45 \pm 1.92 ^{bc}	1.93 \pm 0.10 ^a	3.27 \pm 0.12 ^a
<i>7 days</i>	Control	43.56 \pm 1.62 ^a	2.44 \pm 0.11 ^a	3.07 \pm 0.06 ^b
	Forced-air	45.82 \pm 1.56 ^a	2.24 \pm 0.23 ^a	3.80 \pm 0.44 ^a
	Vacuum	44.46 \pm 1.99 ^a	2.20 \pm 0.10 ^a	3.37 \pm 0.12 ^b
	Room	42.19 \pm 1.89 ^a	2.43 \pm 0.10 ^a	3.27 \pm 0.06 ^b
<i>11 days</i>	Forced-air	33.83 \pm 1.56 ^a	2.28 \pm 0.05 ^b	2.90 \pm 0.10 ^b
	Vacuum	35.02 \pm 3.34 ^a	2.34 \pm 0.07 ^b	3.07 \pm 0.15 ^{ab}
	Room	31.74 \pm 2.43 ^a	2.74 \pm 0.05 ^a	3.20 \pm 0.10 ^a

Values designated by the same letter are not significantly different ($p > 0.05$).
Lower case letter are used for comparisons during storage

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Table A.8 Ascorbic acid, antioxidant activity and total phenolic content of baby cos lettuce during storage at 4 °C with 85 % RH

<i>Storage period</i>	<i>Treatment</i>	<i>Ascorbic acid ($\mu\text{g}/100\text{ g FW}$)</i>	<i>Antioxidant activity ($\mu\text{gTrolox/g}$)</i>	<i>Total phenolic content mgGAE/g FW</i>
<i>1 day</i>	Control	8.92 ± 1.10 ^a	1.70 ± 0.07 ^a	18.36 ± 0.26 ^a
	Forced-air	7.65 ± 0.00 ^a	1.58 ± 0.03 ^b	18.43 ± 0.99 ^a
	Vacuum	9.56 ± 1.91 ^a	1.86 ± 0.04 ^a	19.68 ± 1.13 ^a
	Room	8.28 ± 2.21 ^a	1.65 ± 0.08 ^b	19.06 ± 0.38 ^a
<i>7 days</i>	Control	6.63 ± 1.04 ^{ab}	3.19 ± 0.27 ^c	20.14 ± 0.33 ^a
	Forced-air	7.84 ± 2.09 ^{ab}	3.35 ± 0.32 ^{bc}	20.56 ± 0.95 ^a
	Vacuum	9.04 ± 1.81 ^a	5.06 ± 0.46 ^a	20.91 ± 0.50 ^a
	Room	4.82 ± 1.04 ^b	4.01 ± 0.22 ^b	20.98 ± 0.46 ^a
<i>11 days</i>	Forced-air	6.58 ± 0.52 ^b	3.16 ± 0.54 ^a	21.26 ± 1.00 ^a
	Vacuum	8.38 ± 0.43 ^a	3.35 ± 0.32 ^a	20.62 ± 0.54 ^a
	Room	4.82 ± 1.04 ^c	2.21 ± 0.11 ^b	20.55 ± 0.57 ^a

Values designated by the same letter are not significantly different ($p > 0.05$).
Lower case letter are used for comparisons during storage

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APPENDIX B

STANDARD CURVE

Standard curve of Trolox for DPPH assay

The preparation of 1 mM Trolox stock solution by weighed Trolox 0.025 g, dissolved in absolute ethanol and adjusted to 100 ml in volumetric flask. Trolox stock solution was dilute with absolute ethanol to obtain the series concentrations which presented in Table B.1

Table B.1 Preparation of the series Trolox stock solutions

Concentration of Trolox (μM)	Volume of Trolox stock solution (μl)	Volume of absolute ethanol (μl)
10	10	990
25	25	975
50	50	950
75	75	925
100	100	900
200	200	800
300	300	700
400	400	600
500	500	500
1000	1000	0

The entire solutions were reacted with DPPH \bullet + working solution and measured for their visible absorbance by using spectrophotometer at the respective wavelengths 515 nm immediately (A_{control}) and after 120 min (A_{sample}) of incubation. All measurements were carried out in triplicate. The affinity of the test material to quench DPPH free radicals was evaluated according to the equation:

$$DPPH \text{ scavenging capacity (\%)} = \frac{A \text{ control} - A \text{ sample}}{A \text{ control}} \times 100$$

The % inhibition of the solutions were calculated (Table B.2) and plotted as calibration curve of standard Trolox (Fig. B.1). the representative regression coefficient (r^2) was 0.9589 and the linear regression equation was $y = 319.49x + 7.9151$.

Table B.2 Absorbance value of standard Trolox

Final conc. (μM)	Absorbance at 515 nm for 120 min			% Inhibition			
	1	2	3	1	2	3	Mean \pm SD
control	1.646	1.649	1.640				
10	1.539	1.524	1.519	6.44	7.36	7.66	7.15 \pm 0.63
25	1.509	1.497	1.498	8.27	9.00	8.94	8.73 \pm 0.40
50	1.474	1.469	1.448	10.40	10.70	11.98	11.02 \pm 0.84
75	1.445	1.427	1.414	12.16	13.25	14.04	13.15 \pm 0.95
100	1.413	1.378	1.382	14.10	16.23	15.99	15.44 \pm 1.16
200	1.235	1.214	1.150	24.92	26.20	30.09	27.07 \pm 2.69
300	1.100	1.048	1.032	33.13	36.29	37.26	35.56 \pm 2.16
400	0.913	0.920	0.844	44.50	44.07	48.69	45.75 \pm 2.55
500	0.772	0.725	0.681	53.07	55.93	58.60	55.87 \pm 2.77
1000	0.411	0.328	0.247	75.02	80.06	84.98	80.02 \pm 4.98

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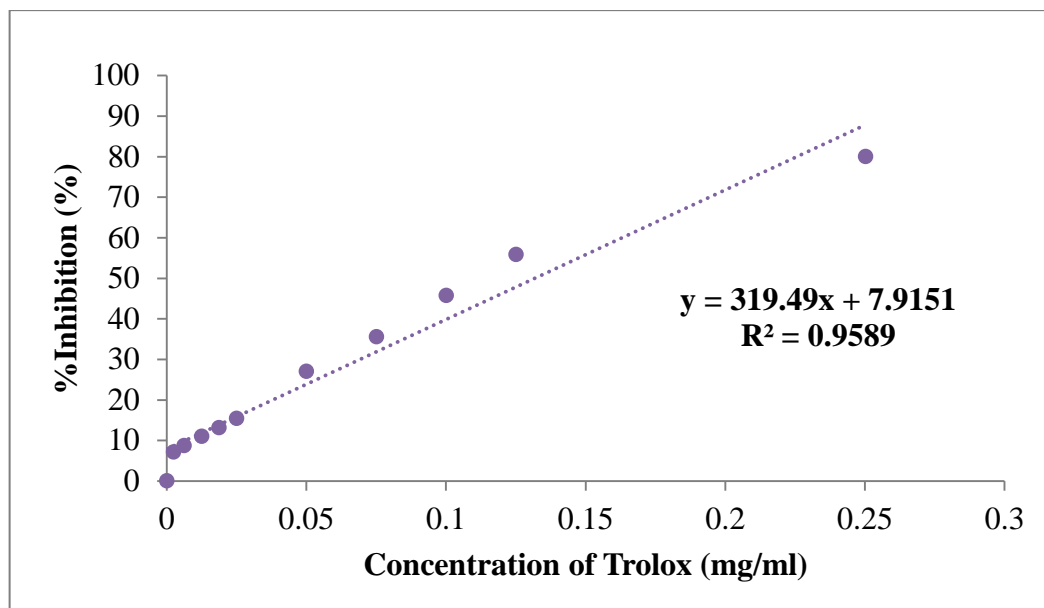


Figure B.1 Standard curve of Trolox

Standard curve of gallic acid for Folin-ciocalteu assay

The preparation of gallic acid stock solution concentration 1000 ppm by weighed gallic acid 0.0100 g, dissolved in absolute ethanol and adjusted to 10 ml in volumetric flask. Gallic acid stock solution was dilute with absolute ethanol to obtain the series concentrations which presented in Table B.3.

The entire solutions were reacted with Folin–Ciocalteu reagent (diluted 1:10 in DI water) and 7.5 % sodium carbonate and measured for their visible absorbance by using spectrophotometer at the respective wavelengths of absorbance of 765 nm for 120 min. All measurements were carried out in triplicate. The absorbance of the solutions (Table B.4) was plotted as calibration curve of standard gallic acid (Fig. B.2). The representative regression coefficient (r^2) was 0.9786 and the linear regression equation was $y = 3.4232x + 0.117$.

Table B.3 Preparation of the series gallic acid stock solutions

Concentration of gallic acid (ppm)	Volume of gallic acid stock solution (μl)	Volume of absolute ethanol (μl)
0	0	1000
5	5	995
10	10	990
25	25	975
50	50	950
75	75	925
100	100	900
150	150	850
200	200	800
250	250	750
300	300	700
400	400	600
500	500	500

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Table B.4 Absorbance value of gallic acid standard

Gallic acid (mg/ml)	Absorbance of gallic acid standard at 765 nm for 120 min			
	1	2	3	Mean ± SD
0	0.087	0.122	0.104	0.104±0.018
0.005	0.114	0.114	0.146	0.125±0.018
0.01	0.146	0.156	0.133	0.145±0.012
0.025	0.185	0.149	0.187	0.174±0.021
0.05	0.26	0.264	0.261	0.262±0.002
0.075	0.371	0.411	0.378	0.387±0.021
0.1	0.402	0.457	0.386	0.415±0.037
0.15	0.495	0.628	0.757	0.627±0.131
0.2	0.861	1.072	0.99	0.974±0.106
0.25	0.94	1.157	1.048	1.048±0.109
0.3	1.19	1.05	1.058	1.099±0.079
0.4	1.464	1.285	1.456	1.402±0.101
0.5	1.305	1.466	1.318	1.363±0.089

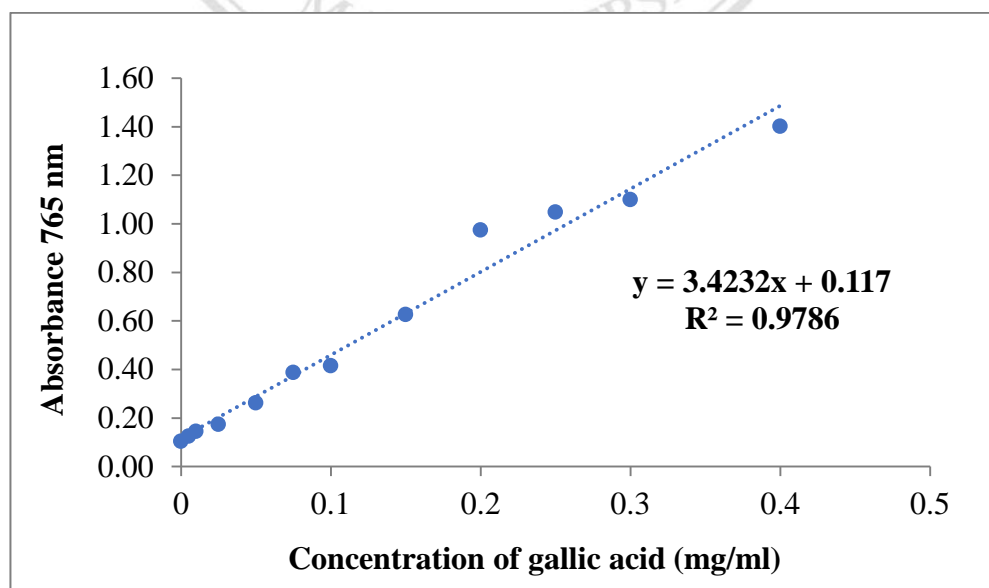


Figure B.2 Standard curve of gallic acid

APPENDIX C

Questionnaire for sensory evaluation

Product: Baby cos lettuce

Name **Date** **No.**.....

Please evaluate baby cos lettuce samples and ratings on the space that best reflects you are feeling about the sample by using the following scores:

1 = Dislike extremely 2 = Dislike very much 3 = Dislike moderately

4 = Dislike slightly 5 = Neither like nor dislike 6 = Like slightly

7 = Like moderately 8 = Like very much 9 = Like extremely

Product attributes	Sample code			
1. Leave color				
2. Freshness and wilting				
3. Browning				
4. Defect and decay				
5. Overall quality				

Suggestion:

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Thank you for your participation

CURRICULUM VITAE

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- Publication** ปรีศนีย์ วังหล่อ คณัญ บุญเกียรติ และพิชญา บุญประสม. 2551. กระบวนการลดอุณหภูมิบรอกโคลี่โดยใช้ระบบสูญญากาศ (วิทยาศาสตร์เกษตรปีที่ 39 ฉบับที่ 3 (พิเศษ): 532-535
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